Anorganisch-organischer Baustoff

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Inventor:	AIGNESBERGER ALOIS DR; MICHAUD HORST DR
Applicant:	SUEDDEUTSCHE KALKSTICKSTOFF
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COMPLETE SPECIFICATION

Resin-containing Building Materials

We, SÜDDEUTSCHE KALKSTICKSTOFF-WERKE AKTIENGESELLSCHAFT, a German body corporate of 8223 Trostberg, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention is concerned with resin-containing building materials.

It is already known to add to building materials thermoplastic materials, such as polyvinyl-chloride, polyvinyl acetate and polystyrene in order to improve their properties.

Thermo-setting plastics materials, for example, unsaturated polyester resins and urea-formaldehyde resins, have also been used for the same purpose. The improvement of the properties of the building materials is due to purely mechanical filling of the intermediate spaces of the building materials with plastics material.

According to the present invention, there is provided a building material consisting of resin, inorganic binders and possibly also fillers, wherein the material contains 0.01 to 30% by weight, based on the inorganic binders, of a resin modified with sulphite, with a sulphonic acid or with rongalite, said resin being a reaction product of an amino-*s*-triazine containing at least two NH_2-groups with formaldehyde.

Production of this building material is characterised in that a solution of the modified amino - *s* - triazine / formaldehyde resin is reacted with such an amount of inorganic binder containing alkaline earth metals that at least one mol of alkaline earth metal is available per mol equivalent of acid groups in the modified resin.

In building materials in accordance with the present invention, there exists a chemical bond between the inorganic and organic components, which bond is believed to improve the strength of the material.

Because of properties, such as good cohesiveness, tensile strength, compression strength, surface quality, high resistance to wear and resistance to chemicals, the materials according to the present invention can be used, for example, for the following purposes:—

Repairs to damaged concrete and also for road construction (Examples 1 and 4);

Concrete fluidisation and ready mixing of concrete (Example 5);

Adhesive materials for ceramics, glass and similar materials (Example 6);

Plastering and finishing on walls, glass, constructional steel, wood and concrete (Examples 6 and 9);

Building plates and floorings (Examples 7 and 8);

Concrete industry (Examples 2 and3);

Sealing and strengthening geological formations, prevention of the formation of working seams and injection mortar (Example 10).

Production of the resin solutions:

Method A. 567 parts by weight of 37% formaldehyde solution are adjusted to a pH of 4.5 and then 294 parts by weight of melamine are added. The mixture is heated to 75°C., until a clear solution forms. The solution is cooled to 45°C. and 222 parts by weight of sodium pyrosulphite are added. 332 parts by volume of water are then added, the solution is adjusted to a pH of 10.5 with an aqueous solution of sodium hydroxide and the solution is heated for 2 hours to 80°C. After cooling to 50°C., the solution is treated with a mixture of 2116 parts by volume of water and 70 parts by weight of concentrated sulphuric acid. After this, the reaction mixture is heated for 5 hours at 50°C. and then adjusted to pH 8.7

vinyl acetate used in the form of an emulsion, the adhesive strength is only increased by about 40%.

Example 5.

The resin solutions are tested for their effectiveness as concrete fluidisers. An addition to concrete of a resin solution, produced in accordance with Method A, in an amount such as to provide 0.01% by weight of resin, referred to cement, improves the flow properties and workability. The resin solutions produced in accordance with Methods B, D and E also have the same good effects. The solution produced in accordance with Method C shows no such effectiveness.

The solution produced in accordance with Method E is dried at about 30°C. The dried product is completely water soluble. The aqueous solution produced from the dried product also acts as a good concrete fluidiser.

Example 6.

To calcium hydroxide mortars, there are added resin solutions, produced in accordance with Method A, in amounts such as to provide resin contents of 8.0%, 16.0% and 22.0%, referred to calcium hydroxide. The mortar adheres well to glass, constructional steel and wood, in contradistinction to mortar without the resin additions. The adhesion of the mortar with a resin content of 16% is approximately twice as strong as that of the mortar with a resin content of 8%. The mortar with a resin content of 22% adheres about 50% more strongly than mortar with a resin content of 16%.

Example 7.

In the case of an addition of the resin solution produced in accordance with Method A to the water used for making plaster of Paris, the amount of water which is necessary to obtain a pourable paste of plaster of Paris is decreased and the setting time of the plaster of Paris increased. Test bodies are prepared of plaster of Paris with and without the addition of resin. The amount of resin added, produced in accordance with Method A, is 1.7%, referred to the plaster of Paris. After drying the test body at 40°C. the Brinell hardness is determined. The test body with the resin addition has a Brinell hardness which is 46% higher than that of a test body without a resin addition.

Example 8.

Xylolith is produced from 1 part by weight calcined magnesite, 1 part by weight sawdust and 3.6 parts by weight of a 50% by weight aqueous solution of magnesium chloride hexahydrate. To some of the test bodies produced from this xylolith, there is added sulphite-modified melamine resin, produced in accordance with Method A, in an amount of 8%, referred to the calcined magnesite, and after 11 days the Brinell hardness is determined. In the test bodies with the resin additive, the Brinell hardness is 22% higher than in the case of the test bodies without the resin additive.

Example 9.

A resin is produced as in Method A. After addition of the sulphuric acid, it is heated for 21 hours instead of for 5 hours which gives a solution which is also miscible in all proportions with water, this solution having a viscosity of 170 cP at 20°C. and a solids content of about 20%.

20 kg. of calcium hydroxide are stirred into 10 kg. of the above resin solution to give a thixotropic coating mixture which does not form a precipitate and which can be readily applied to a surface with a brush. Coatings thereof applied to still damp concrete are waterproof and wipeproof.

Example 10.

Injection mortar is required, for example, for filling in strain channels in prestressed concrete and for strengthening porous geological formations.

What is required is, among other things, good pumping qualities and, in the case of strengthening porous rock, also a reduction of the water loss. Good pumping qualities are attained with concrete fluidisers (see Example 5).

The water losses are determined at 7 atmospheres absolute pressure. Portland cement 275 with a water-cement factor of 0.50 is used.

The water loss in 5 minutes without a resin addition is 450 ml. but with an addition of 1.0% and 5.0% respectively of a solid resin produced in accordance with Method A (referred to the amount of cement) is 50 ml. and 5 ml., respectively. The resin used is that prepared according to Method A.

WHAT WE CLAIM IS:—

1. A building material, consisting of resin, an inorganic binder and possibly a filler, wherein said material contains from 0.01 to 30% by weight, referred to the inorganic binders, of a resin modified with a sulphite, with a sulphonic acid or with rongalite, said resin being a reaction product of an amino-*s*-triazine containing at least two NH_2 groups with formaldehyde.

2. A building material according to Claim 1, substantially as hereinbefore described and exemplified.

3. A process for producing a building material according to Claim 1, wherein a solution of the modified amino-*s*-triazine/formaldehyde resin is reacted with such an

with an aqueous solution of sodium hydroxide.

A solution is obtained with a viscosity of 37 cP at 25°C. and with a solid content of about 20%, which is miscible with water in all proportions.

Method B. 567 parts by weight of 37% formaldehyde solution are adjusted to a pH 4.5 with an aqueous solution of sodium hydroxide and then mixed with 294 parts by weight of melamine. The mixture is then heated to 75°C., until a clear solution is formed, cooled to 45°C. and then 222 parts by weight of sodium pyrosulphite are added. 332 parts by volume of water are then added and the mixture adjusted to a pH of 9.0 with an aqueous solution of sodium hydroxide. The solution is heated for 2 hours to 80°C. After dilution with 2000 parts by volume of water, it is cooled. The viscosity of the solution at 25°C. is 26.2 cP and its solid content is about 20%.

Method C. 20 parts by weight of hexamethylol melamine are heated with 234 parts by volume of water and 6 parts by weight of rongalite for 3 hours at 90°C. A clear solution with a viscosity of 1.3 cP at 20°C. is obtained which has a solid content of about 10%.

Similar types of resin are obtained when rongalite is replaced by a sulphite, bisulphite or pyrosulphite. The period of heating necessary can be reduced, in the manner described in German Patent Specification No. 952495, by the addition of formamidine sulphinic acid.

Method D. Acetoguanamine sulphonic acid (i.e. 2,4-diamino-*sym*-triazinyl-(6) - methanesulphonic acid) is mixed with 30% formaldehyde solution in the molar ratio of 1:4.0, heated to 70°C, adjusted to a pH of 4.0 with an aqueous solution of sodium hydroxide and thereafter heated to 90°C for 2 hours. The solution obtained, which is miscible with water in all proportions has a viscosity of 346 cP at 20°C. and a solids content of about 50%.

Method E. Benzoguanamine sulphonic acid (i.e. 2,4-diamino-*sym*-triazinyl-(6) - benzene-*m* - sulphonic acid) is mixed with 30% formaldehyde solution in the molar ratio of 1:4.0, heated to 70°C., adjusted to a pH of 4.0 with an aqueous solution of sodium hydroxide and thereafter heated for 2 hours to 90°C. The solution obtained which is miscible with water in all proportions, has a viscosity of 2330 cP at 20°C. and a solids content of about 50%.

The following Examples are given for the purpose of illustrating the present invention:—

Example 1.

A sulphite-modified melamine resin solution, produced in accordance with Method A, is added to cement in an amount such as to provide 2% by weight of resin, referred to the amount of cement used, and the mixture applied to concrete. After 28 days the adhesive strength of the new concrete to the old concrete was measured. It is about 240% greater than in the case of a cement without resin added. In order to obtain the same increase in adhesive strength with a conventional polyvinyl acetate emulsion, 6% polyvinyl acetate in the form of an emulsion must be added.

In concrete, to which the melamine resin is added, the compression strength increases, in comparison with a concrete without this addition, by about 40%, while with an addition of 4.5% polyvinyl acetate in emulsion, the compression strength decreases by about 10%.

Example 2.

The resin solution, produced in accordance with Method A, is mixed with cement in an amount such as to give a content of 4% resin, referred to the cement, and, after 28 days, the tensile and compression strengths of the resultant concrete are determined. The tensile strength is about 110% and the compression strength about 65% greater than in the case of a concrete produced without added resin. When using conventional polyvinyl acetate emulsion, with the addition of 4.5% polyvinyl acetate in the form of an emulsion, the tensile strength is increased by about 40% and the compression strength by about 30%.

Example 3.

The resin solution produced in accordance with Method A is added to a concrete in the same amount as in Example 1. After storing for 24 hours in air, the test body is placed in running water and after 28 days—reckoned from the day on which the concrete was treated—the tensile strength is determined. Compared with concrete obtained without the addition of the resin, the tensile strength is increased by about 45%, while it decreases by about 10% in a concrete with an addition of 4.5% of a commercially available polyvinyl acetate in the form of an emulsion.

Example 4.

Rongalite-modified melamine resin solution, produced in accordance with Method C, is added to concrete in an amount such as to provide 2% by weight of resin, referred to the amount of cement used, and then applied to fresh concrete. After 28 days, the adhesive strength of the new concrete to old concrete is measured. The adhesive strength, compared with plain concrete is 90%. The compression strength also increases by 20%, compared with plain concrete. With an addition of 2% by weight, referred to cement, of a commercially available poly-

amount of inorganic binder containing alkaline earth metals that at least one mol of alkaline earth metal is available per mol equivalent of acid groups in the modified resin.

4. A process for producing a building material according to Claim 1, substantially as hereinbefore described and exemplified.

5. Building materials, whenever prepared by the process according to Claim 3 or 4.

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